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Enhanced expression of receptor tyrosine kinase Mer (MERTK) on SOCS3-treated polarized RAW 264.7 anti-inflammatory M2c macrophages

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Hypothesis

The addition of SOCS3 to IL-10 polarized M2c anti-inflammatory macrophages enhances the expression of MERTK receptor when compared to SOCS3 alone, whereas on the other hand SOCS1 does not affect the expression of MERTK receptor

Abstract

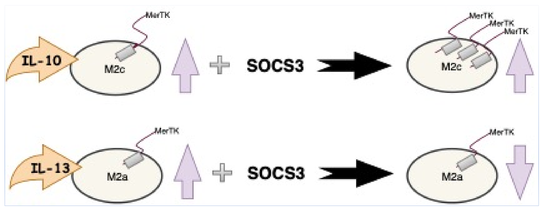
Macrophages are phagocytic cells located in tissues, organs and even circulated within our body as white blood cells. Receptor tyrosine kinase Mer (MERTK) helps in clearing dead neutrophils and other apoptotic cells from damaged tissue sites preventing chronic inflammation and autoimmune disorders. MERTK receptor is expressed mostly on anti-inflammatory M2c macrophages.

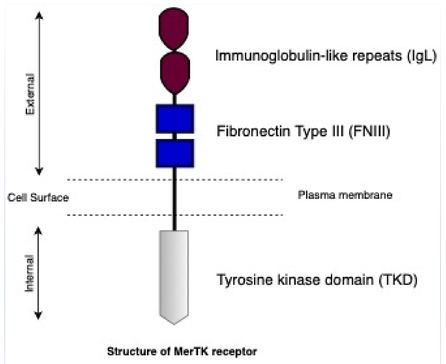
The current study explores the expression rate of the phagocytic receptor MERTK, on macrophages polarized with either IL-10 (M2 cells) or IL-4 or IL-13 (M2a macrophages), following treatment with the suppressor of cytokine signaling SOCS3 in comparison with macrophage polarization with only IL-10 or IL-4 or IL-13. The study exhibits an enhancement in the expression of the phagocytic MERTK receptor on the surface of IL-10 polarized M2c macrophage when treated with SOCS3 in comparison to IL-10 polarized M2c macrophage, IL-4 polarized M2a macrophage and IL- 13 treated M2a macrophage.

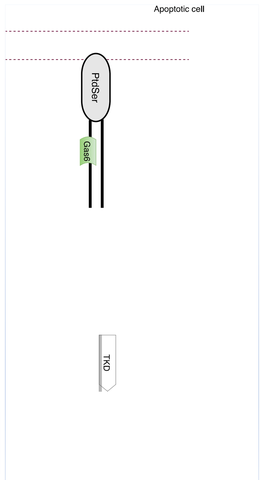
Background

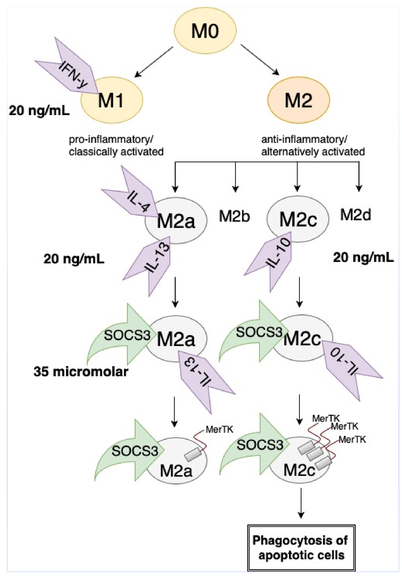
- Macrophages are critical in detecting tissue damage and infection. Resident tissue macrophages initiate the signals for inflammation recruiting neutrophils and blood monocytes which mature into macrophages at sites of infection and aids in the resolution of inflammation
- Based on the local cytokine milieu in tissue sites, macrophages may be polarized into pro-inflammatory M1 or anti-inflammatory M2 phenotypes
- Phosphatidylserine (PtdSer) present on the surface of apoptotic cells release “eat me” signals which are recognized by the two “bridging ligands” of MERTK receptor, Gas6 and ProS. The binding of the ligands to PtdSer initiates intracellular signals leading to phagocytosis of the cell
- MERTK aids in the maintenance of tissue homeostasis and wound healing
- SOCS are a family of intracellular cytokine activated proteins
- Capan (2017) showed an increase in phagocytosis of N2a tumor cells by SOCS3-treated IL-10 polarized M2c macrophages by blocking the calreticulin (CRT) “eat-me” signal
- Madhkhali (2019) noted an upregulation in the phagocytic capacity of these SOCS3 treated macrophages for N2a tumor cells

CTCF = Integrated Density – (Area of selected cell x Mean fluorescence of background readings)

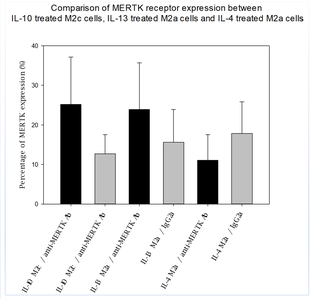


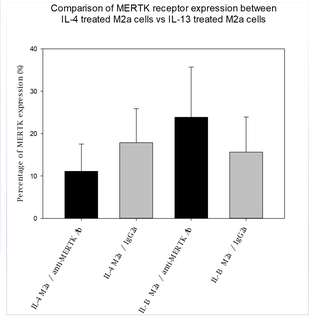


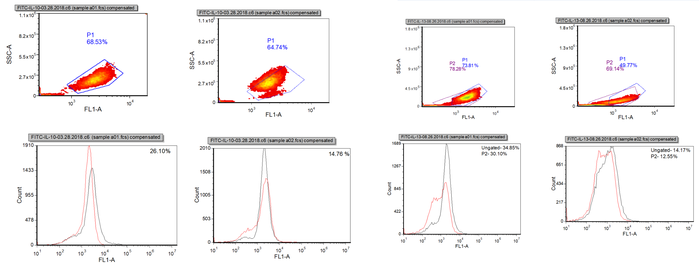


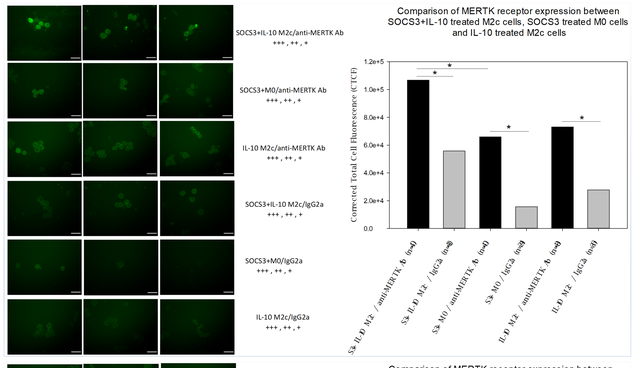


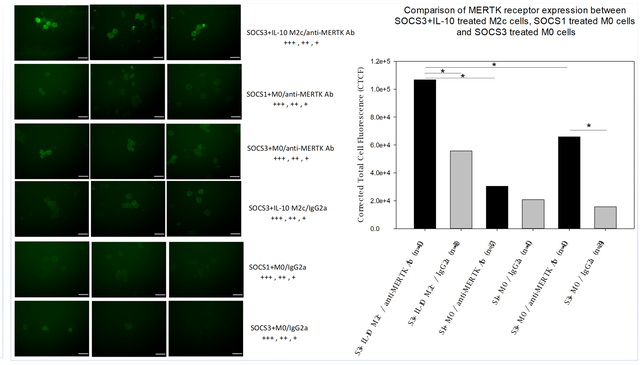
Results

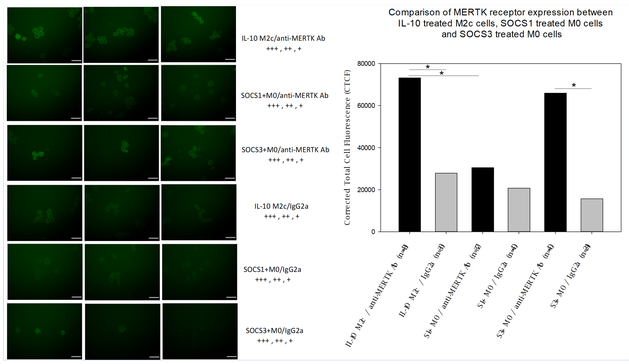


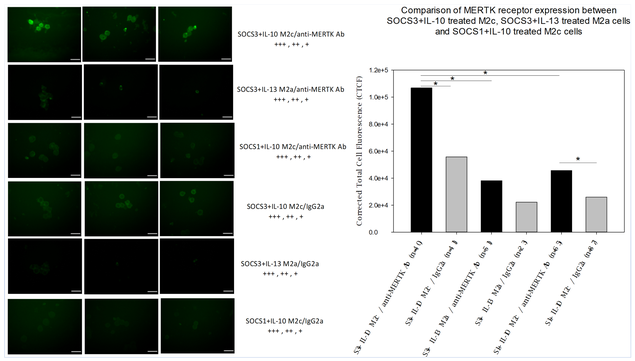


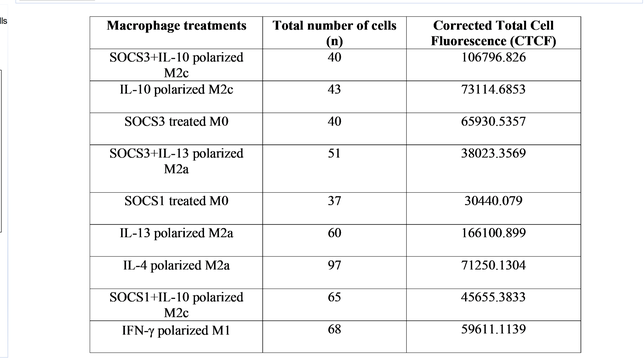












Macrophage treatments	Total number of cells (n)	Corrected Total Cell Fluorescence (CTCF)
SOCS3+IL-10 polarized M2c	40	106796.826
IL-10 polarized M2c	43	73114.6853
SOCS3 treated M0	40	65930.5357
SOCS3+IL-13 polarized M2a	51	38023.3569
SOCS1 treated M0	37	30440.079
IL-13 polarized M2a	60	166100.899
IL-4 polarized M2a	97	71250.1304
SOCS1+IL-10 polarized M2c	65	45655.3833
IFN-γ polarized M1	68	59611.1139

Conclusion

- MERTK receptor expression is enhanced by addition of SOCS3 to M2c macrophages when compared with SOCS3+IL-13 M2a macrophages
- SOCS1 acts as a negative regulator of MERTK when treated with M0 macrophage and with IL-10 polarized M2c phenotype
- The increase in the expression of MERTK receptor on IL-13 polarized M2a macrophages, but not when compared to IL-4 polarized M2a macrophage, showcase the dynamic, diverse, and plastic nature of macrophages as they readily switch from one phenotype to another
- The current study supports the data of Capan (2017) and Madhkhali (2019) on the positive impact of SOCS3

References

Capan, C. (2017). Effects of SOCS1 and SOCS3 Peptide Mimetics on Macrophage Phagocytosis of Malignant Cells. Wright State University.
Dransfield, I., Zagórska, A., Lew, E. D., Michail, K., & Lemke, G. (2015). Mer receptor tyrosine kinase mediates both tethering and phagocytosis of apoptotic cells. *Cell death & disease*, *6*(2), e1646.
Madkhali, T. (2019). The Effects of SOCS1 and SOCS3 Peptide Mimetics on Macrophage Phagocytosis of Malignant Cells. Wright State University.
Mantovani, A., Sica, A., Sozzani, S., Allavena, P., Vecchi, A., & Locati, M. (2004). The chemokine system in diverse forms of macrophage activation and polarization. *Trends in immunology*, *25*(12), 677-686.
Xu, W., Roos, A., Schlagwein, N., Woltman, A. M., Daha, M. R., & van Kooten, C. (2006). IL-10–producing macrophages preferentially clear early apoptotic cells. *Blood*, *107*(12), 4930-4937.
Zhang, B., Fang, L., Wu, H.M., Ding, P.S., Xu, K., and Liu, R.Y (2016). Mer receptor tyrosine kinase negatively regulates Lipoteichoic Acid-Induced Inflammatory response via P13K/Akt and SOCS3. *Molecular Immunology,* 76, 98-107.